

WHAT IS CLAIMED IS:

1. A method for cleaning a plasma etching apparatus comprising the steps of:
filling a chamber with Cl₂ or a mixed gas of Cl₂ and a fluorine-based gas
5 wherein BO_x is adhered to an inside of the chamber as a residue; and
generating plasma from the Cl₂ or the mixed gas of Cl₂ and the fluorine-based
gas to remove the BO_x.
2. A method for cleaning a plasma etching apparatus according to claim 1,
10 wherein a method selected from the group consisting of an RIE etching method, an
ICP etching method, an ECR etching method, a helicon wave etching method, a helical
resonance etching method and a pulse modulation etching method is adopted in the
plasma etching apparatus.
- 15 3. A method for cleaning a plasma etching apparatus according to claim 1,
wherein the fluorine-based gas is selected from the group consisting of CF₄, SF₆ and
NF₃.
- 20 4. A method for cleaning a plasma etching apparatus according to claim 2,
wherein the fluorine-based gas is selected from the group consisting of CF₄, SF₆ and
NF₃.
- 25 5. A method for cleaning a plasma etching apparatus according to claim 1,
wherein an etching gas is replaced with Cl₂ or a mixed gas of Cl₂ and a fluorine-based
gas each of which is added with O₂, and plasma is generated from the Cl₂ or the mixed

gas of Cl₂ and the fluorine-based gas each of which is added with O₂.

6. A method for cleaning a plasma etching apparatus according to claim 2,
wherein an etching gas is replaced with Cl₂ or a mixed gas of Cl₂ and a fluorine-based
5 gas each of which is added with O₂, and plasma is generated from the Cl₂ or the mixed
gas of Cl₂ and the fluorine-based gas each of which is added with O₂.

7. A method for cleaning a plasma etching apparatus according to claim 3,
wherein an etching gas is replaced with Cl₂ or a mixed gas of Cl₂ and a fluorine-based
10 gas each of which is added with O₂, and plasma is generated from the Cl₂ or the mixed
gas of Cl₂ and the fluorine-based gas each of which is added with O₂.

8. A method for cleaning a plasma etching apparatus comprising the steps of:
performing plasma etching using a gas containing BCl₃ as an etching gas in a
15 chamber;
replacing the etching gas in the chamber with Cl₂ or a mixed gas of Cl₂ and a
fluorine-based gas after the plasma etching; and
generating plasma from the Cl₂ or the mixed gas of Cl₂ and the fluorine-based
gas.

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9. A method for cleaning a plasma etching apparatus according to claim 8,
wherein a method selected from the group consisting of an RIE etching method, an
ICP etching method, an ECR etching method, a helicon wave etching method, a helical
resonance etching method and a pulse modulation etching method is adopted in the
25 plasma etching apparatus.

10. A method for cleaning a plasma etching apparatus according to claim 8,
wherein the fluorine-based gas is selected from the group consisting of CF₄, SF₆ and
NF₃.

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11. A method for cleaning a plasma etching apparatus according to claim 9,
wherein the fluorine-based gas is selected from the group consisting of CF₄, SF₆ and
NF₃.

10 12. A method for cleaning a plasma etching apparatus according to claim 8,
wherein the etching gas is replaced with Cl₂ or a mixed gas of Cl₂ and a fluorine-based
gas each of which is added with O₂, and plasma is generated from the Cl₂ or the mixed
gas of Cl₂ and the fluorine-based gas each of which is added with O₂.

15 13. A method for cleaning a plasma etching apparatus according to claim 9,
wherein the etching gas is replaced with Cl₂ or a mixed gas of Cl₂ and a fluorine-based
gas each of which is added with O₂, and plasma is generated from the Cl₂ or the mixed
gas of Cl₂ and the fluorine-based gas each of which is added with O₂.

20 14. A method for cleaning a plasma etching apparatus according to claim 10,
wherein the etching gas is replaced with Cl₂ or a mixed gas of Cl₂ and a fluorine-based
gas each of which is added with O₂, and plasma is generated from the Cl₂ or the mixed
gas of Cl₂ and the fluorine-based gas each of which is added with O₂.

25 15. A method for cleaning a plasma etching apparatus comprising the steps of:

performing plasma etching using a gas containing BCl_3 as an etching gas in a chamber;

replacing the etching gas in the chamber with a mixed gas of Cl_2 and a fluorine-based gas or Cl_2 after the plasma etching; and

5 generating plasma from the mixed gas of Cl_2 and the fluorine-based gas or the Cl_2 before a plasma etching using a gas that is inhibited from generating plasma by BO_x as an etching gas.

16. A method for cleaning a plasma etching apparatus according to claim 15,
10 wherein a method selected from the group consisting of an RIE etching method, an ICP etching method, an ECR etching method, a helicon wave etching method, a helical resonance etching method and a pulse modulation etching method is adopted in the plasma etching apparatus.

15 17. A method for cleaning a plasma etching apparatus according to claim 15,
wherein the fluorine-based gas is selected from the group consisting of CF_4 , SF_6 and
 NF_3 .

18. A method for cleaning a plasma etching apparatus according to claim 16,
20 wherein the fluorine-based gas is selected from the group consisting of CF_4 , SF_6 and
 NF_3 .

19. A method for cleaning a plasma etching apparatus according to claim 15,
wherein the etching gas is replaced with Cl_2 or a mixed gas of Cl_2 and a fluorine-based
25 gas each of which is added with O_2 , and plasma is generated from the Cl_2 or the mixed

gas of Cl₂ and the fluorine-based gas each of which is added with O₂.

20. A method for cleaning a plasma etching apparatus according to claim 16,
wherein the etching gas is replaced with Cl₂ or a mixed gas of Cl₂ and a fluorine-based
5 gas each of which is added with O₂, and plasma is generated from the Cl₂ or the mixed
gas of Cl₂ and the fluorine-based gas each of which is added with O₂.

21. A method for cleaning a plasma etching apparatus according to claim 17,
wherein the etching gas is replaced with Cl₂ or a mixed gas of Cl₂ and a fluorine-based
10 gas each of which is added with O₂, and plasma is generated from the Cl₂ or the mixed
gas of Cl₂ and the fluorine-based gas each of which is added with O₂.

22. A method for cleaning a plasma etching apparatus comprising the steps of:
performing plasma etching using a gas containing BCl₃ as an etching gas in a
15 chamber;
replacing the etching gas in the chamber with Cl₂ or a mixed gas of Cl₂ and a
fluorine-based gas after the plasma etching; and
generating plasma from the Cl₂ or the mixed gas of Cl₂ and the fluorine-based
gas before performing plasma etching using a gas containing SF₆ as an etching gas.

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23. A method for cleaning a plasma etching apparatus according to claim 22,
wherein a method selected from the group consisting of an RIE etching method, an
ICP etching method, an ECR etching method, a helicon wave etching method, a helical
resonance etching method and a pulse modulation etching method is adopted in the
25 plasma etching apparatus.

24. A method for cleaning a plasma etching apparatus according to claim 22, wherein the fluorine-based gas is selected from the group consisting of CF₄, SF₆ and NF₃.

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25. A method for cleaning a plasma etching apparatus according to claim 23, wherein the fluorine-based gas is selected from the group consisting of CF₄, SF₆ and NF₃.

10 26. A method for cleaning a plasma etching apparatus according to claim 22, wherein the etching gas is replaced with Cl₂ or a mixed gas of Cl₂ and a fluorine-based gas each of which is added with O₂, and plasma is generated from the Cl₂ or the mixed gas of Cl₂ and the fluorine-based gas each of which is added with O₂.

15 27. A method for cleaning a plasma etching apparatus according to claim 23, wherein the etching gas is replaced with Cl₂ or a mixed gas of Cl₂ and a fluorine-based gas each of which is added with O₂, and plasma is generated from the Cl₂ or the mixed gas of Cl₂ and the fluorine-based gas each of which is added with O₂.

20 28. A method for cleaning a plasma etching apparatus according to claim 24, wherein the etching gas is replaced with Cl₂ or a mixed gas of Cl₂ and a fluorine-based gas each of which is added with O₂, and plasma is generated from the Cl₂ or the mixed gas of Cl₂ and the fluorine-based gas each of which is added with O₂.

25 29. A method for cleaning a plasma etching apparatus including a chamber,

said method comprising the steps of:

filling the chamber with Cl₂ or a mixed gas of Cl₂ and a fluorine-based gas;

and

generating plasma from the Cl₂ or the mixed gas of Cl₂ and the fluorine-based

5 gas,

wherein a part of the chamber is made from quartz, and a surface of the quartz
is at least partly exposed to an inside of the chamber,

wherein BO_x is adhered to the surface of the quartz at least partly exposed to
the inside of the chamber as a residue.

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30. A method for cleaning a plasma etching apparatus according to claim 29,
wherein a method selected from the group consisting of an RIE etching method, an
ICP etching method, an ECR etching method, a helicon wave etching method, a helical
resonance etching method and a pulse modulation etching method is adopted in the
15 plasma etching apparatus.

31. A method for cleaning a plasma etching apparatus according to claim 29,
wherein the fluorine-based gas is selected from the group consisting of CF₄, SF₆ and
NF₃.

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32. A method for cleaning a plasma etching apparatus according to claim 30,
wherein the fluorine-based gas is selected from the group consisting of CF₄, SF₆ and
NF₃.

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33. A method for cleaning a plasma etching apparatus according to claim 29,

wherein an etching gas is replaced with Cl₂ or a mixed gas of Cl₂ and a fluorine-based gas each of which is added with O₂, and plasma is generated from the Cl₂ or the mixed gas of Cl₂ and the fluorine-based gas each of which is added with O₂.

5 34. A method for cleaning a plasma etching apparatus according to claim 30, wherein an etching gas is replaced with Cl₂ or a mixed gas of Cl₂ and a fluorine-based gas each of which is added with O₂, and plasma is generated from the Cl₂ or the mixed gas of Cl₂ and the fluorine-based gas each of which is added with O₂.

10 35. A method for cleaning a plasma etching apparatus according to claim 31, wherein an etching gas is replaced with Cl₂ or a mixed gas of Cl₂ and a fluorine-based gas each of which is added with O₂, and plasma is generated from the Cl₂ or the mixed gas of Cl₂ and the fluorine-based gas each of which is added with O₂.

15 36. A method for cleaning a plasma etching apparatus including a chamber, said method comprising the steps of:

 performing plasma etching using a gas containing BCl₃ as an etching gas in the chamber;

 replacing the etching gas in the chamber with a mixed gas of Cl₂ and a fluorine-based gas or Cl₂ after the plasma etching; and
20 generating plasma from the mixed gas of Cl₂ and the fluorine-based gas or the Cl₂,

 wherein a part of the chamber is made from quartz, and a surface of the quartz is at least partly exposed to an inside of the chamber.

37. A method for cleaning a plasma etching apparatus according to claim 36,
wherein a method selected from the group consisting of an RIE etching method, an
ICP etching method, an ECR etching method, a helicon wave etching method, a helical
resonance etching method and a pulse modulation etching method is adopted in the
5 plasma etching apparatus.

38. A method for cleaning a plasma etching apparatus according to claim 36,
wherein the fluorine-based gas is selected from the group consisting of CF₄, SF₆ and
NF₃.

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39. A method for cleaning a plasma etching apparatus according to claim 37,
wherein the fluorine-based gas is selected from the group consisting of CF₄, SF₆ and
NF₃.

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40. A method for cleaning a plasma etching apparatus according to claim 36,
wherein the etching gas is replaced with Cl₂ or a mixed gas of Cl₂ and a fluorine-based
gas each of which is added with O₂, and plasma is generated from the Cl₂ or the mixed
gas of Cl₂ and the fluorine-based gas each of which is added with O₂.

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41. A method for cleaning a plasma etching apparatus according to claim 37,
wherein the etching gas is replaced with Cl₂ or a mixed gas of Cl₂ and a fluorine-based
gas each of which is added with O₂, and plasma is generated from the Cl₂ or the mixed
gas of Cl₂ and the fluorine-based gas each of which is added with O₂.

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42. A method for cleaning a plasma etching apparatus according to claim 38,

wherein the etching gas is replaced with Cl₂ or a mixed gas of Cl₂ and a fluorine-based gas each of which is added with O₂, and plasma is generated from Cl₂ or the mixed gas of Cl₂ and the fluorine-based gas each of which is added with O₂.

5 43. A method for cleaning a plasma etching apparatus including a chamber,

said method comprising the steps of:

performing plasma etching using a gas containing BCl₃ as an etching gas in

the chamber;

replacing the etching gas in the chamber with Cl₂ or a mixed gas of Cl₂ and a

10 fluorine-based gas after the plasma etching; and

generating plasma from the Cl₂ or the mixed gas of Cl₂ and the fluorine-based

gas before performing plasma etching using a gas that is inhibited from generating

plasma by BO_x as an etching gas,

wherein a part of the chamber is made from quartz, and a surface of the quartz

15 is at least partly exposed to an inside of the chamber.

44. A method for cleaning a plasma etching apparatus according to claim 43,

wherein a method selected from the group consisting of an RIE etching method, an

ICP etching method, an ECR etching method, a helicon wave etching method, a helical

20 resonance etching method and a pulse modulation etching method is adopted in the

plasma etching apparatus.

45. A method for cleaning a plasma etching according to claim 43, wherein

the fluorine-based gas is selected from the group consisting of CF₄, SF₆ and NF₃.

46. A method for cleaning a plasma etching apparatus according to claim 44, wherein the fluorine-based gas is selected from the group consisting of CF₄, SF₆ and NF₃.

5 47. A method for cleaning a plasma etching apparatus according to claim 43, wherein the etching gas is replaced with Cl₂ or a mixed gas of Cl₂ and a fluorine-based gas each of which is added with O₂, and plasma is generated from the Cl₂ or the mixed gas of Cl₂ and the fluorine-based gas each of which is added with O₂.

10 48. A method for cleaning a plasma etching apparatus according to claim 44, wherein the etching gas is replaced with Cl₂ or a mixed gas of Cl₂ and a fluorine-based gas each of which is added with O₂, and plasma is generated from the Cl₂ or the mixed gas of Cl₂ and the fluorine-based gas each of which is added with O₂.

15 49. A method for cleaning a plasma etching apparatus according to claim 45, wherein the etching gas is replaced with Cl₂ or a mixed gas of Cl₂ and a fluorine-based gas each of which is added with O₂, and plasma is generated from the Cl₂ or the mixed gas of Cl₂ and the fluorine-based gas each of which is added with O₂.

20 50. A method for cleaning a plasma etching apparatus including a chamber, said method comprising the steps of:

 performing plasma etching using a gas containing BCl₃ as an etching gas in the chamber;

 replacing the etching gas in the chamber with Cl₂ or a mixed gas of Cl₂ and a fluorine-based gas after the plasma etching; and

generating plasma from the Cl₂ or the mixed gas of Cl₂ and the fluorine-based gas before performing plasma etching using a gas containing SF₆ as an etching gas, wherein a part of the chamber is made from quartz, and a surface of the quartz is at least partly exposed to an inside of the chamber.

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51. A method for cleaning a plasma etching apparatus according to claim 50, wherein a method selected from the group consisting of an RIE etching method, an ICP etching method, an ECR etching method, a helicon wave etching method, a helical resonance etching method and a pulse modulation etching method is adopted in the
10 plasma etching apparatus.

52. A method for cleaning a plasma etching apparatus according to claim 50, wherein the fluorine-based gas is selected from the group consisting of CF₄, SF₆ and NF₃.

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53. A method for cleaning a plasma etching apparatus according to claim 51, wherein the fluorine-based gas is selected from the group consisting of CF₄, SF₆ and NF₃.

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54. A method for cleaning a plasma etching apparatus according to claim 50, wherein the etching gas is replaced with Cl₂ or a mixed gas of Cl₂ and a fluorine-based gas each of which is added with O₂, and plasma is generated from the Cl₂ or the mixed gas of Cl₂ and the fluorine-based gas each of which is added with O₂.

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55. A method for cleaning a plasma etching apparatus according to claim 51,

wherein the etching gas is replaced with Cl₂ or a mixed gas of Cl₂ and a fluorine-based gas each of which is added with O₂, and plasma is generated from the Cl₂ or the mixed gas of Cl₂ and the fluorine-based gas each of which is added with O₂.

5 56. A method for cleaning a plasma etching apparatus according to claim 52, wherein the etching gas is replaced with Cl₂ or a mixed gas of Cl₂ and a fluorine-based gas each of which is added with O₂, and plasma is generated from the Cl₂ or the mixed gas of Cl₂ and the fluorine-based gas each of which is added with O₂.

10 57. A method for plasma etching comprising the steps of:
 performing plasma etching a conductive film using a gas containing BCl₃ gas as an etching gas in a chamber;

 replacing the etching gas in the chamber with Cl₂ or a mixed gas of Cl₂ and a fluorine-based gas after the plasma etching; and

15 generating a plasma from the Cl₂ or the mixed gas of Cl₂ and the fluorine-based gas before performing plasma etching using a gas that is inhibited from generating plasma by BO_x as an etching gas.

58. A method for plasma etching according to claim 57, wherein a method
20 selected from the group consisting of an RIE etching method, an ICP etching method, an ECR etching method, a helicon wave etching method, a helical resonance etching method and a pulse modulation etching method is adopted in the plasma etching apparatus.

25 59. A method for plasma etching according to claim 57, wherein the

fluorine-based gas is selected from the group consisting of CF₄, SF₆ and NF₃.

60. A method for plasma etching according to claim 58, wherein the fluorine-based gas is selected from the group consisting of CF₄, SF₆ and NF₃.

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61. A method for plasma etching according to claim 57, wherein the etching gas is replaced with Cl₂ or a mixed gas of Cl₂ and a fluorine-based gas each of which is added with O₂, and plasma is generated from the Cl₂ or the mixed gas of Cl₂ and the fluorine-based gas each of which is added with O₂.

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62. A method for plasma etching according to claim 58, wherein the etching gas is replaced with Cl₂ or a mixed gas of Cl₂ and a fluorine-based gas each of which is added with O₂, and plasma is generated from the Cl₂ or the mixed gas of Cl₂ and the fluorine-based gas each of which is added with O₂.

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63. A method for plasma etching according to claim 59, wherein the etching gas is replaced with Cl₂ or a mixed gas of Cl₂ and a fluorine-based gas each of which is added with O₂, and plasma is generated from the Cl₂ or the mixed gas of Cl₂ and the fluorine-based gas each of which is added with O₂.

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64. A method for plasma etching comprising the steps of:
performing plasma etching using a gas containing BCl₃ gas as an etching gas
in a chamber;
replacing the etching gas in the chamber with Cl₂ or a mixed gas of Cl₂ and a
25 fluorine-based gas after the plasma etching;

generating plasma from the Cl₂ or the mixed gas of Cl₂ and the fluorine-based gas; and

performing plasma etching using a gas containing SF₆ gas as an etching gas.

5 65. A method for plasma etching according to claim 64, wherein a method selected from the group consisting of an RIE etching method, an ICP etching method, an ECR etching method, a helicon wave etching method, a helical resonance etching method and a pulse modulation etching method is adopted in the plasma etching apparatus.

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66. A method for plasma etching according to claim 64, wherein the fluorine-based gas is selected from the group consisting of CF₄, SF₆ and NF₃.

15 67. A method for plasma etching according to claim 65, wherein the fluorine-based gas is selected from the group consisting of CF₄, SF₆ and NF₃.

20 68. A method for plasma etching according to claim 64, wherein the etching gas is replaced with Cl₂ or a mixed gas of Cl₂ and a fluorine-based gas each of which is added with O₂, and plasma is generated from the Cl₂ or the mixed gas of Cl₂ and the fluorine-based gas each of which is added with O₂.

25 69. A method for plasma etching according to claim 65, wherein the etching gas is replaced with Cl₂ or a mixed gas of Cl₂ and a fluorine-based gas each of which is added with O₂, and plasma is generated from the Cl₂ or the mixed gas of Cl₂ and the fluorine-based gas each of which is added with O₂.

70. A cleaning method for plasma etching apparatus according to claim 66, wherein the etching gas is replaced with Cl₂ or a mixed gas of Cl₂ and a fluorine-based gas each of which is added with O₂, and plasma is generated from the Cl₂ or the mixed gas of Cl₂ and the fluorine-based gas each of which is added with O₂.

5 71. A method for plasma etching using a plasma etching apparatus including a chamber, said method comprising the steps of:

10 performing plasma etching using a gas containing BCl₃ as an etching gas in the chamber;

 replacing the etching gas in the chamber with Cl₂ or a mixed gas of Cl₂ and a fluorine-based gas after the plasma etching;

 generating plasma from Cl₂ or the mixed gas of Cl₂ and the fluorine-based gas; and

15 performing plasma etching using a gas that is inhibited from generating plasma by BO_x as an etching gas,

 wherein a part of the chamber is made from quartz, and a surface of the quartz is at least partly exposed to an inside of the chamber.

20 72. A method for plasma etching according to claim 71, wherein a method selected from the group consisting of an RIE etching method, an ICP etching method, an ECR etching method, a helicon wave etching method, a helical resonance etching method and a pulse modulation etching method is adopted in the plasma etching apparatus.

73. A method for plasma etching according to claim 71, wherein the fluorine-based gas is selected from the group consisting of CF₄, SF₆ and NF₃.

74. A method for plasma etching according to claim 72, wherein the
5 fluorine-based gas is selected from the group consisting of CF₄, SF₆ and NF₃.

75. A method for plasma etching according to claim 71, wherein the etching
gas is replaced with Cl₂ or a mixed gas of Cl₂ and a fluorine-based gas each of which is
added with O₂, and plasma is generated from the Cl₂ or the mixed gas of Cl₂ and the
10 fluorine-based gas each of which is added with O₂.

76. A method for plasma etching according to claim 72, wherein the etching
gas is replaced with Cl₂ or a mixed gas of Cl₂ and a fluorine-based gas each of which is
added with O₂, and plasma is generated from the Cl₂ or the mixed gas of Cl₂ and the
15 fluorine-based gas each of which is added with O₂.

77. A method for plasma etching according to claim 74, wherein the etching
gas is replaced with Cl₂ or a mixed gas of Cl₂ and a fluorine-based gas each of which is
added with O₂, and plasma is generated from the Cl₂ or the mixed gas of Cl₂ and the
20 fluorine-based gas each of which is added with O₂.

78. A method for plasma etching using a plasma etching apparatus including a
chamber, said method comprising the steps of:
performing plasma etching using a gas containing BCl₃ as an etching gas in
25 the chamber;

replacing the etching gas in the chamber with Cl₂ or a mixed gas of Cl₂ and a fluorine-based gas after the plasma etching;
generating plasma from the Cl₂ or the mixed gas of Cl₂ and the fluorine-based gas; and

5 performing plasma etching using a gas containing SF₆ gas as etching gas,
wherein a part of the chamber is made from quartz, and a surface of the quartz
is at least partly exposed to an inside of the chamber.

79. A method for plasma etching according to claim 78, wherein a method
10 selected from the group consisting of an RIE etching method, an ICP etching method,
an ECR etching method, a helicon wave etching method, a helical resonance etching
method and a pulse modulation etching method is adopted in the plasma etching
apparatus.

15 80. A method for plasma etching according to claim 78, wherein the
fluorine-based gas is selected from the group consisting of CF₄, SF₆ and NF₃.

81. A method for plasma etching according to claim 79, wherein the
fluorine-based gas is selected from the group consisting of CF₄, SF₆ and NF₃.

20 82. A method for plasma etching according to claim 78, wherein the etching
gas is replaced with Cl₂ or a mixed gas of Cl₂ and a fluorine-based gas each of which is
added with O₂, and plasma is generated from the Cl₂ or the mixed gas of Cl₂ and the
fluorine-based gas each of which is added with O₂.

83. A method for plasma etching according to claim 79, wherein the etching gas is replaced with Cl₂ or a mixed gas of Cl₂ and a fluorine-based gas each of which is added with O₂, and plasma is generated from the Cl₂ or the mixed gas of Cl₂ and the fluorine-based gas each of which is added with O₂.

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84. A method for plasma etching according to claim 80, wherein the etching gas is replaced with Cl₂ or a mixed gas of Cl₂ and a fluorine-based gas each of which is added with O₂, and plasma is generated from the Cl₂ or the mixed gas of Cl₂ and the fluorine-based gas each of which is added with O₂.

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85. A method for manufacturing a semiconductor device comprising the steps of:

laminating a first conductive film and a second conductive film in sequence over an island shape semiconductor film with a gate insulating film interposed
15 therebetween;

etching the first conductive film and the second conductive film to form a first shape of the first conductive film and a first shape of the second conductive film, respectively, by using a first etching gas;

replacing the first etching gas in a chamber with Cl₂ or a mixed gas of Cl₂ and
20 a fluorine-based gas wherein BO_x is adhered to an inside of the chamber as a residue;
and

generating plasma from the Cl₂ or the mixed gas of Cl₂ and the fluorine-based
gas to remove the BO_x; and

25 anisotropic etching the first shape of the first conductive film and the first shape of the second conductive film to form a second shape of the first conductive film

and a second shape of the second conductive film, respectively.

86. A method for manufacturing a semiconductor device according to claim 85, wherein a width of the second shape of the first conductive film is longer than that 5 of the second shape of the second conductive film in a channel length direction.

87. A method for manufacturing a semiconductor device according to claim 85, wherein a method selected from the group consisting of an RIE etching method, an ICP etching method, an ECR etching method, a helicon wave etching method, a helical 10 resonance etching method and a pulse modulation etching method is adopted in the plasma etching apparatus.

88. A method for manufacturing a semiconductor device according to claim 86, wherein a method selected from the group consisting of an RIE etching method, an ICP etching method, an ECR etching method, a helicon wave etching method, a helical 15 resonance etching method and a pulse modulation etching method is adopted in the plasma etching apparatus.

89. A method for manufacturing a semiconductor device according to claim 20 85, wherein the fluorine-based gas is selected from the group consisting of CF₄, SF₆ and NF₃.

90. A method for manufacturing a semiconductor device according to claim 25 86, wherein the fluorine-based gas is selected from the group consisting of CF₄, SF₆ and NF₃.

91. A method for manufacturing a semiconductor device according to claim
87, wherein the fluorine-based gas is selected from the group consisting of CF₄, SF₆
and NF₃.

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92. A method for manufacturing a semiconductor device according to claim
85, wherein an etching gas is replaced with Cl₂ or a mixed gas of Cl₂ and a
fluorine-based gas, or Cl₂ gas each of which is added with O₂, and plasma is generated
from the Cl₂ or the mixed gas of Cl₂ and the fluorine-based gas each of which is added
10 with O₂ to remove the BO_x.

93. A method for manufacturing a semiconductor device according to claim
86, wherein the etching gas is replaced with Cl₂ or a mixed gas of Cl₂ and a
fluorine-based gas each of which is added with O₂, and plasma is generated from the
15 Cl₂ or the mixed gas of Cl₂ and the fluorine-based gas each of which is added with O₂
to remove the BO_x.

94. A method for manufacturing a semiconductor device according to claim
87, wherein the etching gas is replaced with Cl₂ or a mixed gas of Cl₂ and a
20 fluorine-based gas each of which is added with O₂, and plasma is generated from the
Cl₂ or the mixed gas of Cl₂ and the fluorine-based gas each of which is added with O₂
to remove the BO_x.

95. A method for manufacturing a semiconductor device according to claim
25 89, wherein the etching gas is replaced with Cl₂ or a mixed gas of Cl₂ and a

fluorine-based gas each of which is added with O₂, and plasma is generated from the Cl₂ or the mixed gas of Cl₂ and the fluorine-based gas each of which is added with O₂ to remove the BO_x.